

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

STREAM CROSSING

(No.)

CODE 578

DEFINITION

A stabilized area or structure constructed across a stream to provide a travel way for people, livestock, equipment, or vehicles.

PURPOSE

- Improve water quality by reducing sediment, nutrient, organic, and inorganic loading of the stream
- Reduce streambank and streambed erosion
- Provide crossing for access to another land unit

CONDITIONS WHERE PRACTICE APPLIES

This practice applies to all land uses where an intermittent or perennial watercourse exists and a ford, bridge, or culvert type crossing is desired for livestock, people, and /or equipment.

CRITERIA

General Criteria Applicable to all Purposes

Location. Stream crossings shall be located in areas where the streambed is stable or where grade control can be provided to create a stable condition. Adverse environmental effects shall be minimized. Avoid sites where channel grade or alignment changes abruptly, excessive seepage or instability is evident, overfalls exist, or large tributaries enter the stream.

Locate crossings, where possible, out of shady riparian areas to discourage cattle loafing time in the stream.

Stream crossings shall provide a way for normal passage of water, fish and other aquatic animals within the channel during all seasons of the year.

Access Roads. Where high rates of erosion of the adjacent roadways that slope towards the crossing threaten to deliver an excessive amount of sediment to the drainage, install measures to minimize erosion of the roadside ditch, road surface, and/or cut slopes. Where the stream crossing is installed as part of a roadway, the crossing shall be in accordance with Access Road (560).

Width. The stream crossing shall provide an adequate travel-way width for the intended use. A stream crossing shall have a travel-way no less than 10 feet wide. Width shall be measured from the upstream end to the downstream end of the stream crossing and shall not include the side slopes.

Side Slopes. All cuts and fills for the stream crossing shall have side slopes that are stable for the soil involved. Side slopes of earth cuts or fills shall be no steeper than 2.5 horizontal to 1 vertical. Rock cuts or fills shall be no steeper than 1.5 horizontal to 1 vertical.

Stream Approaches. Approaches to the stream crossing shall blend with existing site conditions, where possible, and shall not be steeper than 4 horizontal to 1 vertical. The approaches shall be stable, have a gradual ascent or descent grade, and be underlain with suitable material, as necessary, to withstand repeated and long term use. The minimum width of the approaches shall be equal to the width of the crossing surface.

Surface runoff shall be diverted around the approaches to prevent erosion of the approaches.

Roadside ditches shall be directed into a diversion or away from the crossing surface.

Rock. All rock shall be chosen to withstand exposure to air, water, freezing, and thawing. When rock is used it shall be sufficiently large and dense so that it is not mobilized by design flood flows.

Fencing. Areas adjacent to the stream crossing shall be permanently fenced or otherwise excluded, as needed, to manage livestock access to the crossing.

Cross-stream fencing at fords shall be accomplished with breakaway wire, swinging floodgates, hanging electrified chain, or other devices to allow the passage of floodwater debris during high flows.

All fencing shall be designed and constructed in accordance with Fence (382).

Vegetation. Vegetation shall be established on all channel slopes, berms, spoil, and other disturbed areas according to Critical Area Planting (342).

Channel side slopes and other areas too steep for regular seeding equipment are to be seeded as soon as possible after excavation or disturbance.

Criteria for Culvert and Bridge Crossings

Design of culverts and bridges shall be consistent with sound engineering principles and shall be adequate for the use, type of road, and class of vehicle. Culverts and bridges shall have sufficient capacity to convey the design flow without appreciably altering the stream flow characteristics.

Culverts shall be sized to handle at least the bankfull flow or the peak runoff from the 2-year, 24-hour peak discharge, whichever is less.

At least one culvert pipe shall be placed on or below grade with the existing stream bottom. Additional culverts may be used at various elevations to maintain terrace or floodplain hydraulics.

The length of the culvert shall be adequate to extend the full width of the crossing including side slopes.

Crossings shall be adequately protected so that out-of-bank flows safely bypass without structure or streambank damage, or erosion of the crossing fill.

Compacted fill will be used to form the crossing. The minimum depth of compacted fill over the culvert shall be equal to one-half the diameter of the culvert or 24 inches, whichever is greater. The compacted fill shall be built up over the culvert so that any stream overflow will cross the road at a point away from the culvert. The compacted fill and pipe outlet shall be protected from erosion, if needed, with riprap. The total thickness of riprap shall be at least 18 inches. A concrete headwall or grouted riprap may be required in cases of severe attack. The driving surface over culverts shall be topped with Class II non-woven geotextile and a minimum of 6 inches of AASHTO No. 1 coarse aggregate or other suitable materials.

Acceptable culvert materials include concrete, corrugated metal, corrugated plastic, new or used high quality steel, and other materials.

Acceptable bridge materials include concrete, steel, and wood.

Criteria for Ford Crossings

When ford crossings are used the cross-sectional area of the crossing shall not be less than the natural channel cross-sectional area. A portion of the crossing shall be depressed at or below the average stream bottom elevation, when needed, to keep base flows or low flows concentrated.

Cutoff walls shall be provided at the upstream and downstream edges of ford-type stream crossings, when needed, to protect against undercutting.

The finished top surface of the ford-type stream crossing in the bottom of the watercourse shall be no higher than the original stream bottom at the upstream edge of the ford crossing. If the downstream edge of the ford crossing is above the original stream bottom, the ford crossing shall be stabilized in accordance with Stream Channel Stabilization (584).

Concrete Fords

Concrete ford crossings shall be used only where the foundation of the stream crossing is determined to have adequate bearing strength.

Concrete shall have a minimum compressive strength of 3,500 psi at 28 days. Concrete ford crossings shall have a minimum thickness of placed concrete of 5 inches with minimum reinforcement of #4 reinforcing bars on 15-inch centers each way. The concrete slab shall be poured on a minimum 4-inch thick rock base unless the foundation is otherwise acceptable.

Precast concrete panels may be used in lieu of cast-in-place concrete slabs. Precast concrete units shall comply with ACI 525 or 533, or as otherwise acceptable for local conditions.

When heavy equipment loads are anticipated, the concrete slab shall be designed using an appropriate procedure as described in American Concrete Institute, ACI 360, Design of Slabs on Grade.

Geocell and/or Rock Ford Crossings

Ford crossings made of stabilizing material such as rock riprap are often used in steep areas subject to flash flooding where normal flow is shallow or intermittent. Rock ford crossings with geotextile may be used when the site has a soft or unstable subgrade. The NEH, Parts 642 and 643, and AASHTO M-288 (latest edition) provide guidance in quality specification and geotextile selection.

The bed of the channel shall be excavated to the necessary depth and width and covered with geotextile material. The geotextile material shall be installed on the excavated surface of the ford and shall extend across the bottom of the stream and at least up to the 10-year, 24-hour peak discharge elevation or the bank full elevation, whichever is less.

The geotextile material shall be covered with at least 6 inches of crushed rock. If using geocells, the cells shall be at least 6 inches deep. All geosynthetic material shall be suitably durable and shall be installed in accordance with the manufacturer's recommendations, including the use of staples, clips, and anchor pins.

Where rock is used for ford-type stream crossings for livestock, use a hoof contact zone or alternative surfacing method over the surfacing rock. Generally, 4 inches of hoof contact zone is necessary. This material does not have to meet any velocity criteria. This layer is expected to be replaced periodically by the landowner as livestock traffic or runoff events erode the surface material.

At a minimum, all rock ford stream crossings shall be designed to remain stable during the 10-year, 24-hour peak discharge.

CONSIDERATIONS

Avoid or minimize stream crossings, when possible, through evaluation of alternative trail or travel-way locations.

Ford crossings have the least detrimental impact on water quality when crossing is infrequent. Ford crossings are adapted for crossing wide, shallow watercourses with firm streambeds.

Where stream crossings are used, evaluate the need for safety measures such as guardrails at culvert or bridge crossings or water depth signage at ford crossings.

PLANS AND SPECIFICATIONS

Plans and specifications for stream crossings shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose.

The following list of Construction Specifications is intended as a guide to selecting the appropriate specifications for each specific project. The list includes most, but may not contain all, of the specifications needed for a specific project:

IA-1	Site Preparation
IA-5	Pollution Control
IA-6	Seeding and Mulching for Protective Cover
IA-21	Excavation
IA-23	Earthfill
IA-32	Concrete for Minor Structures
IA-45	Plastic (PVC, PE) Pipe
IA-51	Corrugated Metal Pipe
IA-52	Steel Pipe Conduits
IA-61	Loose Rock Riprap
IA-92	Fences
IA-95	Geotextile

OPERATION AND MAINTENANCE

An operation and maintenance (O&M) plan shall be developed and implemented for the life of the practice. Specified actions shall include normal repetitive activities in the application and use of the practice (operation), and repair and upkeep of the practice (maintenance).

The stream crossing, appurtenances, and associated fence should be inspected at least annually and after each major storm event with repairs made as needed. The hoof contact layer is expected to be replaced periodically by the landowner as livestock traffic or runoff events erode the surface material.

REFERENCES

USDA-NRCS, National Engineering Handbook (NEH), Part 650, Engineering Field Handbook (EFH), Chapter 3